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# ENVIRONMENT VIEWS

Part One

VOLUME SEVEN
NUMBER FOUR
JULY/AUGUST 1984

SECOND CLASS MAIL REGISTRATION NUMBER 4405 EDMONTON

## Environmental Research

ISSN 0701-9637

ENVIRONMENT VIEWS

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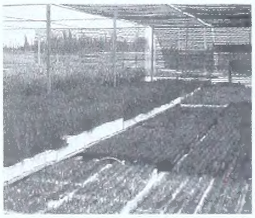

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*Environment Views* is published bi-monthly by Alberta Environment. Each issue deals with a specific topic from various viewpoints with the aim of increasing awareness of environmental issues among Albertans. *Environment Views* is directed by an independent board with representation from environmental groups, government and industry. The views expressed by the publication are not necessarily those of Alberta Environment.

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**Cover Photo:** Tim Belec

Alberta
ENVIRONMENT

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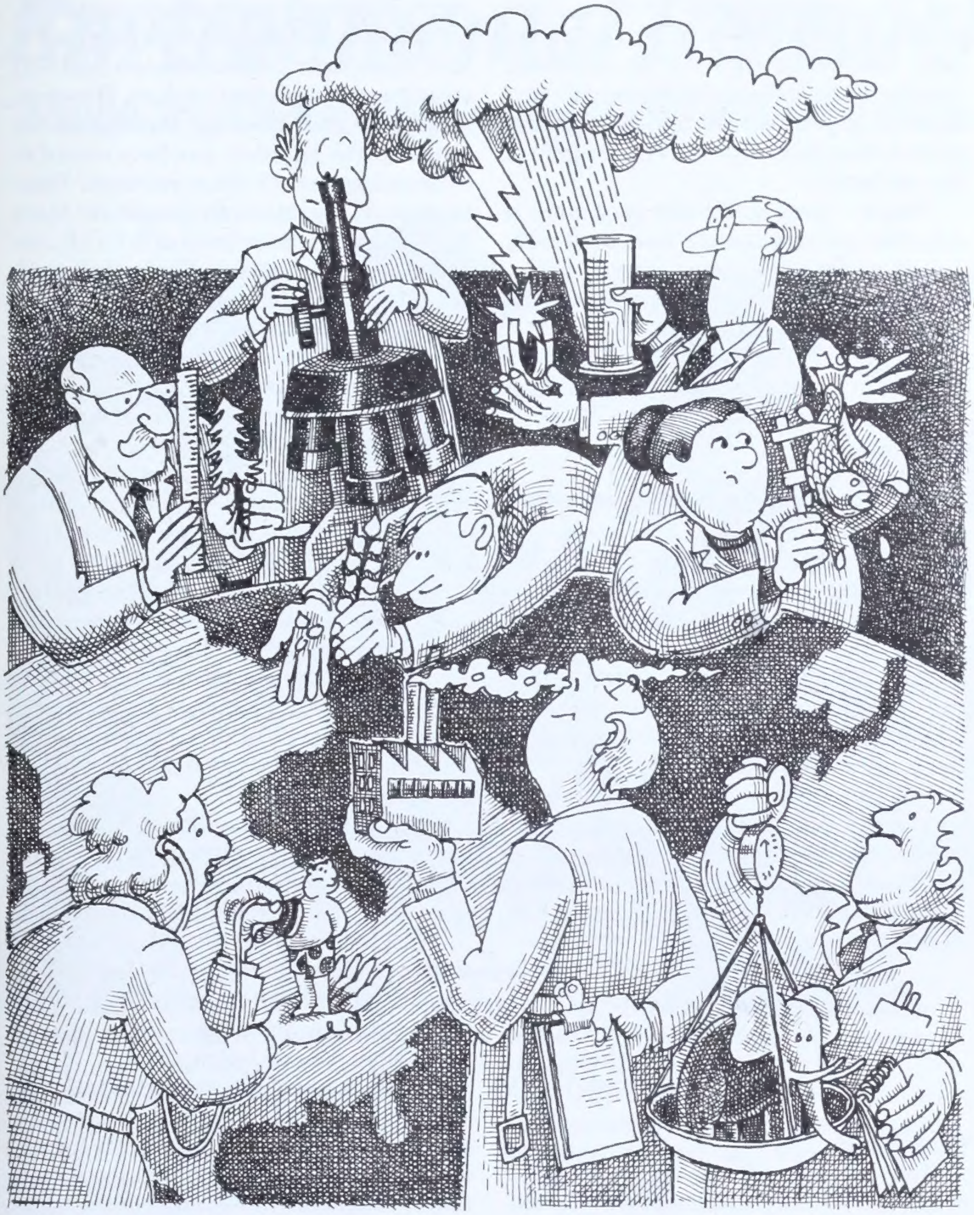
# Editor's Notebook



WARREN CLARK

In this issue of *Environment Views*, we begin a two-part examination of environmental research by defining it and looking at policy and funding.

In all three areas, neat answers have eluded us. Definition is difficult, except in the broadest terms, because of the extensive overlap of many areas of environmental research with other fields. Policy has, to date, been highly fragmented. Alberta does not have an overall policy on such matters as the priorities assigned to the different areas of environmental research. Funding, too, is a difficult matter to pin down, with very few specific figures available for the amount of money spent on environmental research.

The reason for the difficulty in finding concrete answers lies in the very nature of environmental research: almost everyone we talked to in the field used the term "interdisciplinary". Environmental research is not biology, chemistry, or physics. It is most often all of the above, with some mathematics and social sciences thrown in.

Norma Ramage quotes Dr. Sherman Weaver, executive director of the Alberta Environmental Centre in Vegreville: "...You can define the environment as anything which affects life, so therefore, environmental research is research into anything which affects life."

Dr. Harby Sandhu, senior research manager of the research management division of Alberta Environment, offers a definition which is only slightly more limiting: "Scientific activity undertaken with the primary aim of maintaining, restoring or improving the environment or of predicting changes in the environment."

As this research cuts across scientific disciplines, it also cuts across the lines separating different sectors of government and industry. To illustrate: in the field of water quality, for example, there is research by engineers into water and wastewater treatment technology; by ecologists into the health of the water ecosystem; by fisheries biologists into habitat and the condition and number of fish populations; by industry seeking to meet pollution standards; and by government departments concerned with maintaining public health, just to offer a few examples.

There are similar examples in many other areas. How much of soils research is agricultural and how much is environmental?

An attempt is being made to make the most of the interdisciplinary quality of environmental research in two "umbrella" programs, the Reclamation Research Program and the Acid Deposition Research Program. Both are joint industry/government ventures, and both attempt to maximize the communication and co-operation among researchers of different disciplines tackling related problems.

In our next issue, we will be looking at these two programs and at a sampling of other environmental research projects undertaken by industry, government and universities. The November/December issue of *Environment Views* will look at the environmental impacts of the sour gas industry in Alberta. This issue is at the planning stage now, so if you have any ideas about what we should include, please contact us. As usual, we are very happy to have your comments and suggestions.

Maryhelen Vicars, a former journalist, is the freelance editor of *Environment Views*.

# Letters

Dear Editor:

I recently came across one of your publications and was very impressed with the contents and the quality of writing. We are a new company incorporated primarily for the purpose of completing difficult environmental earth jobs and other irrigation related specialized work. I am certain that your publication can be useful in keeping us abreast of the latest developments in these fields.

Please put us on your mailing list and I would appreciate a copy of the May-June issue, as soon as possible.

Rudy Spiess
General Manager
Earthworks International Construction Ltd.
Calgary

Dear Editor:

Reading through the "Editor's Notebook" of the March-April 1984 *Environment Views,* it finally struck me what it was about your magazine that had bothered me slightly for some time now.

You seem to overlook, to a large extent, the role the *parks* play in environmental education — both in the classical sense, to students, and in the broad sense, to all segments of the public.

I admit to a certain bias — I was, for many years, a park interpretive naturalist. I am now an interpretive planner for the national parks.

The phrase that finally "clicked" in your article was "we look at the three main avenues of environmental action: education (both school-based and .... relying on the media) — etc. etc.

I think *your* background and bias may be showing, just as mine is! While I don't belittle the contribution made by classroom and mass-media attempts at "consciousness-raising", etc., I feel that "hands-on" experience vastly outweighs — or at least *prepares* the student/adult for — the classroom and mass-media attempts at envir. ed.

Banff National Park welcomes *four million* visitors annually. Jasper, Elk Island, Waterton, Wood Buffalo — and the many provincial parks, large and small — and the municipal parks and nature centres welcome many millions more. Most, if not all of these people have their "consciousness raised" *more* by being *in* the natural environment and experiencing it first-hand than any school or mass-media based attempt ever will. The experience and — for many — the revelation/knowledge they then gain from park interpretive efforts is an important "avenue of environmental education", too! Without it, what we call "off-site" environmental education methods would surely be less successful.

Please — keep up the very good work in the areas you traditionally have dealt with. Try to expand your scope slightly, too — there's a whole brand of environmental education you are ignoring!

Jim Robertson
Interpretive Planning Officer
Lake Louise Development Program

Dear Editor:

In your March/April edition which contains a guide to international environmental organizations, you mention the World Wildlife Fund but then give the address for the U.S. organization. Perhaps you didn't know there is also a World Wildlife Fund in Canada, and I have enclosed our most recent annual report to bring you up to date on our activities. Incidentally, we have been alive and active in this country since 1967.

Your information regarding our worldwide activities is also out of date. World Wildlife Fund internationally has now allocated over one hundred million dollars to 3,500 conservation projects around the world.

Monte Hummel
Executive Director
World Wildlife Fund Canada
60 St. Clair Ave. E., Suite 201,
Toronto Ontario M4T 1N5

Dear Editor:

This is just a note to congratulate all concerned in your department with the excellent May/June issue on River Basin Planning. I trust it has been well circulated and read.

H.B. McEwen
Deputy Minister,
Alberta Agriculture

Dear Editor:

The January/February 1984 issue of *Environment Views* was of particular interest to me, dealing as it did with the history of the environment movement in Alberta. As one of the "originals" in the Edmonton area, I can recall the time when words like "environment" and "ecology" and "pollution" were not only unpopular to some, even suspect, they were completely unfamiliar and unpronouncable to most people — how wonderful it is to reflect, with the help of this issue, on the progress made in a mere fifteen years.

It is truly commendable that you have chosen to take a look at the people and events of the early environment movement, for whatever successes we have today are at least in some part attributable to a relatively small band of dedicated workers. However, in spite of good coverage throughout the articles in this last issue, you have missed or bypassed several of the movements' finest leaders and organizations, people like Mary Van Stolk and Louise Swift of S.T.O.P.; the Hocking family, especially Drake, the founder of the Edmonton Anti-Pollution Group; Joy Finlay, the first environment educator; Dorothy Broadbent, Henry Lembicz and Elmer Kure of the Red Deer area; Ed Daniels and Penny Bonnet of the University of Alberta interdisciplinary group, Joe Mackenzie of the T.B. Association and a host of others. Denis Wighton's efforts would fill a book — nobody came near to him in energy, enthusiasm and plain hard work. And much that was accomplished would have been left undone without the encouragement and facilities made available through Betti Hewes, then director of the Edmonton Social Planning Council, Gerry Wright, of the U. of A.'s Department of Extension, and the U of A Department of Sociology.

Dr. Hocking and Dr. Daniels conducted the first research into air and water quality *(Air Pollution in Edmonton; Water Pollution in Edmonton),* prior to any government research (their work prompted government to be more research-oriented). Denis Wighton conducted the first public information and education meetings — he travelled throughout Alberta, often alone.

There is a wonderful story to be told, and from several small errors in your articles I suspect that too much of it is already forgotten or misunderstood. Perhaps the time is ripe to search out the full istory of the environment movement in Alberta before the records disappear forever, for it would be a shame to ignore or neglect the earliest trials of such outstanding people. Their experiences could be an example and inspiration to the new crop of environmentalists, for the battles are far from over.

Sheila Abercrombie
North Cooking Lake

P.S. It would be interesting to resurrect the first good sociological study done in Alberta re environment — *Environmental Edmonton* — and make a few comparisons. I managed the study and still have a copy.

*Letters continued on page 25*

Norma Ramage

# What is Environmental Research?

## "Almost limitless variables in a constantly-changing environment"

Soil research at the Alberta Environmental Centre at Vegreville.

TIM BELEC

Hunched over test tubes in his laboratory, the white-smocked physicist is in complete control of the experiment. He holds most components constant, varying one at a time to measure its effect. He records it and then varies another. At all times, he's in control.

Pity then the poor environmental researcher dealing with almost limitless variables in a constantly-changing environment. Instead of chemicals in a test tube, he must deal with fluid, complex living organisms and ecological systems in continual flux.

If an environmental researcher studies the effect of chemical wastes on a river, he must deal not only with the chemical effluent but also with the influence of other factors such as weather, soil and man. He must define the effect of that effluent on a myriad of substances: bottom sediment, fish, plant life, bacteria, water and man.

It's no wonder that environmental researchers like Dr. Sherman Weaver, a physicist by training, often think wistfully of the simpler, more precisely defined questions of physics and chemistry.

"If you're studying a river, there are so many variables to handle, so many parameters to try to control," says Weaver. "Nothing is ever constant."

> ***"By definition, environmental research is anything. You can define the environment as anything which affects life, so therefore, environmental research is research into anything that affects life."***

Environmental researcher Dr. Allan Legge of the University of Calgary gives this example to illustrate the problems faced in this kind of study:

"A physicist trying to find out how acid rain affects a forest will go to that forest and he'll look at the aerodynamics of the raindrops.

"The environmental researcher has to look at the effect of the acid rain on leaf surfaces, on the soil, on the root systems and on the interaction among them all. Then he has to look at the leaf chemistry and soil chemistry. After that, he had to decide whether the effect is good or bad and if it's bad, how to mitigate it."

What is this extremely complex science called environmental research? That's not an easy question to answer. For one thing, it's very new. The history of substantial environmental research in Alberta doesn't date back more than 15 years. And because it's new, scientists are still trying to define it and still disputing just what is environmental research and what it isn't.

Dr. Harby Sandhu of the research management division of Alberta Environment has defined it as "scientific activity under-

BILL MCKEOWN

**Harby Sandhu**

taken with the primary aim of maintaining, restoring or improving the environment or for predicting changes in the environment."

Weaver, executive director of the Alberta Environmental Centre in Vegreville, says simply, "By definition, environmental research is anything. You can define the environment as anything which affects life, so therefore, environmental research is research into anything that affects life."

Obviously, such a wide-ranging discipline can present special problems not found in older, more established forms of research, explains Dr. Dixon Thompson of the University of Calgary's Faculty of Environmental Design.

"The difference between environmental research and other kinds of research is not with the research itself. Good research is good research. It's with the nature of the problems that environmental researchers are asked to address," Thompson explains.

"There is the uncertainty factor. You're never sure just what you're looking for. There are the long time frames because the environment is slow to react. There are the number of variables involved. And since it's a multidisciplinary science, there's the difficulty of successfully managing all these disciplines."

But the biggest problem in environmental research, according to Weaver, is the *first* problem: Asking the right question.

"It's taken me 20 years as a scientist to learn that the hardest step is the first step. Environmental research for the last 20 years has been asking the wrong questions."

Researchers may define the problem too narrowly to get useful answers, says Weaver, or they may tackle a problem so vast it couldn't be solved in their lifetimes.

But how do researchers arrive at the right question? That's not easy, says the U of C's Legge. For one thing, researchers may not be asking enough questions, looking at enough variables.

"Say a researcher is asked to evaluate the impact of air pollution on a forest," says Legge. "If he goes into the forest and sees all the needles on the trees are turning brown and dropping off, he knows there's a problem.

"But say the needles aren't turning brown and falling off. Does that mean there isn't a problem, does that mean there isn't any air pollution present? Not necessarily, and at that point the researcher has to take a look at how the forest works, at the interaction among trees and soil and air.

"Too many researchers are just looking for brown needles. That's the question they're being asked to answer but it's not necessarily the right question."

Legge likens environmental research to a jigsaw puzzle where "you don't need every piece but one piece isn't enough."

How much, then, is enough? That's another contentious issue in environmental research, says Ron Findlay, manager of environmental affairs for Amoco Canada.

"You never complete a research problem to a degree where you get definitive answers," Findlay says. "You just keep going until you have enough indicators to make a decision."

There is also, says Findlay, a cost-benefit factor to consider. How much is the research going to cost and is society willing to pay the price to fix the problem? He cites the U.S. approach to the acid rain problem where researchers are being asked how much it will cost to clean up the problem and whether the solution is worth the expense.

But many researchers are critical of this cost-benefit approach. Says Legge: "If a

Dr. Allan Legge at the Kananaskis Centre for Environmental Research of the University of Calgary.

TIM BELEC

TIM BELEC

Ron Findlay

question is worth asking, it's worth time and funding. Too much environmental research is like Monty Python's film "The Meaning of Life." We're told 'Here's $25,000 — now give me the meaning of life.'"

One of the problems is that the public and government want answers to environmental questions yesterday and researchers feel they aren't given enough time to find proper answers.

Jean Crepin, owner of Edmonton-based Norwest Soil Research Ltd., says too often environmental research is crisis management, investigation of a problem that already exists.

"A funding agency may not see any reason in providing money to research something that may happen. They want research done on a problem they can see now."

Weaver points out that all the quick and easy answers to environmental problems have already been worked out, such as how to clean up an oil spill or measure the level of contaminants in a river. "What's left are the deeper, more basic problems that take much longer."

But even when environmental researchers have the time and the money, they may not be able to come up with a finite answer that will satisfy the public. Too often, they are trying to prove a negative, something philosophers say is impossible.

Says Weaver: "a classic example is that of smoking and its connection to lung cancer. The only way to prove that beyond doubt would be to experiment with a group of human beings over a long period of time, controlling them so that the only variable in their lives was whether or not they smoked. Of course, that's impossible.

"Instead, we have to depend on what law courts call circumstantial evidence."

And sometimes the basis for collecting that evidence is called into question. A lot of environmental research is based on pre-set standards, but how accurate and applicable are these standards? For example, a few years ago, it was discovered that naturally occurring ozone levels in some areas were far higher than accepted maximum standards set by government!

The reason for this, explains Norwest's Crepin, may be that the standards we use are often established for places very different from Alberta.

"Environmental research is new and we

Although environmental research involves many unique problems, like any research, it has some basic requirements.

Dr. Sherman Weaver, executive director of the Alberta Environmental Centre in Vegreville outlined the following seven steps for good research:

**1 Plan:** Draw up a model. Define the problem and ask the right question. A particularly crucial step in environmental research and one that sounds easier than it is.

**2 Sample:** The quality of data in any research is critically dependent on the soundness of sampling techniques. This is particularly true in environmental research. If the sampling isn't thorough, scientists may find themselves in the position of researchers testing for mercury in the North Saskatchewan several years ago. Samples were taken from the river's north bank downstream from Edmonton, producing negative findings and completely missing the mercury pouring into the river from drain outlets on the south bank.

**3 Measurement:** All equipment must be properly tested, reliable and accurate. Staff must be experienced and properly trained so that measurements are reliable.

**4 Calibration & Standardization:** Measurements must be checked against accepted standards such as those set by governments or those provided by agencies like the U.S. National Bureau of Standards.

**5 Quality Assurance:** This step includes a variety of things including good facilities, proper procedures, proper review techniques and, most crucially, checking results with other researchers.

**6 Statistical Procedures:** These must be set up carefully to ensure proper analysis once numbers are obtained from earlier steps in the research.

**7 Documentation:** Last but far from least, complete and accurate documentation must accompany the research findings. The numbers or the findings alone are not enough. Anyone reviewing the research should be able to see exactly how it was done.

*— Norma Ramage*

Vegetation sampling at Plateau Mountain site.

DAVE MUSSELL

tend to look for guidance, to look at what New York or California is doing because we don't want to keep re-inventing the wheel every time. But while I don't think we need to repeat the basic research, I think we have to test the applicability of those standards for Alberta."

And sometimes, says Legge, the standards may not be extensive enough, and he gives the concern over sour gas plant emissions in Pincher Creek as an example.

"We send people down there to check against the standards for air quality and water quality and the amount of hydrogen sulphide. But what if the problem has nothing to do with the emissions they're measuring? What if the problem is caused by some emission that isn't being measured or by something completely different?

"It all comes back to asking the right questions. If you don't, you won't get the right answers."

But even when the right questions are asked, when the funding is adequate and the time is unlimited, environmental researchers face an additional problem, caused by the multidisciplinary nature of the research. How do you make experts as diverse as chemists, microbiologists, sociologists and engineers co-operate and communicate? Because if they don't, most experts agree, environmental research will never get off the ground.

"We don't just need people to quickly tell us the amounts of a chemical in water. We need others to tell us why it's there, its effect on people or livestock and how to remove it," explains Weaver. "There are so many questions, you have to take a team approach."

Says Legge, "Environmental problems are so complex that if you try to approach them from distinct points of view, if you send out a dozen different disciplines each tackling the problem strictly from their own perspective, then the work doesn't get done."

But researchers concede this co-operation isn't easy to obtain. How, for instance, do you get fish people to talk to plant people? And what common ground for communication is there between a biologist who deals with unpredictable living organisms and an engineer who is trained to predict everything to the third and fourth decimal place of a stress equation?

Says Weaver, whose job at Vegreville forces him to deal with just these questions, "It takes constant care and feeding, this multidisciplinary organism."

And it's this co-operation, or lack of it, that has been one of the biggest stumbling blocks in the development of environmental research, says Thompson. He believes most accepted, conventional management methods simply cannot be applied to a field as unique as environmental research.

The problem to date has been that many managers of environmental research projects have known little about science and researchers haven't been interested in management.

However, people like Thompson and Weaver are hopeful of improvement because scientists have at least accepted that a multidisciplinary approach is absolutely crucial.

"What we need now," says Thompson, "is to teach management skills as part of our science programs at the university level," something the U of C's faculty of environmental design is already doing.

Crepin believes that if complete interdisciplinary co-operation comes into being, environmental research will advance by leaps and bounds.

"In the Third World, in places like India where they are working in agricultural research under horrendous conditions, because people have worked together, they have moved forward by a mile. Their steps are giant.

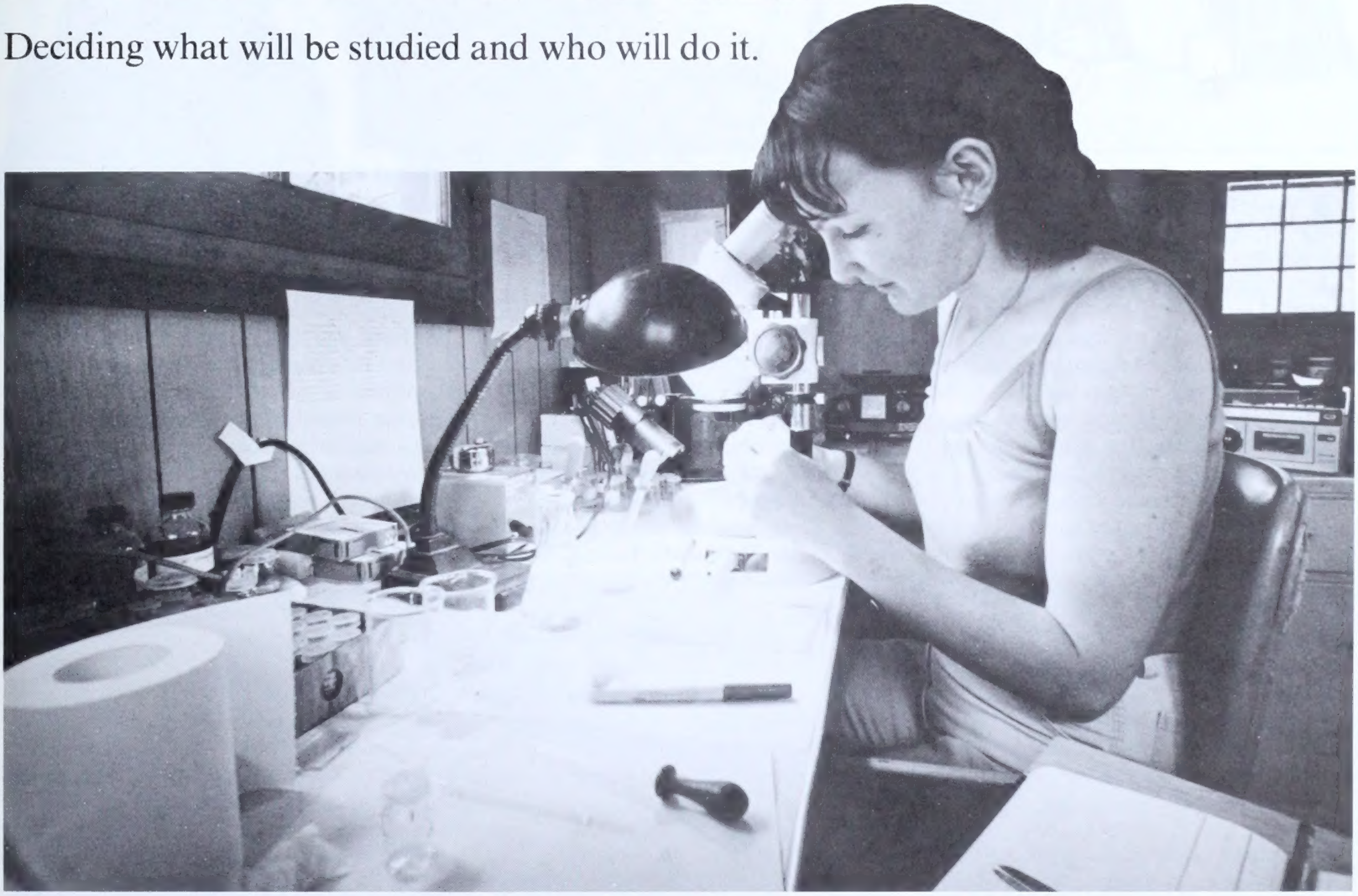
"If we all agree here not to try to do all the research individually, then a lot of the problems of funding and time will disappear and we, too, will take giant steps."

Norma Ramage is a Calgary journalism instructor and freelance writer.

Gillian Sniatynski

# *Research Policies and Priorities*

## Deciding what will be studied and who will do it.



TIM BELEC

One of the biggest environmental research programs in Alberta, still being planned, will study the effects of sulphur dioxide emissions on a wide range of environmental elements.

The Acid Deposition Research Program, funded jointly by government and industry, will cost $8 million over seven years. Essentially, it is Alberta's response to the growing national and global concern about acid rain.

What policy statements, in what high level conference rooms and corner office suites, dictated the acceptability of that particular program at this particular time? Chances are the decision was influenced by many important factors — not all of which are included in formal policy statements.

The Acid Deposition Research Program had a history of workshops, reviews and ad hoc committees going back several years. The need for research in the area had long been perceived and scientifically justified.

So it's fair to ask why now, and why $8 million? — and to conclude that a rising public awareness of the dangers of acid rain has brought politics into the decision-making process.

***Ultimately, getting a research proposal approved may depend on who you know, and how well you know them.***

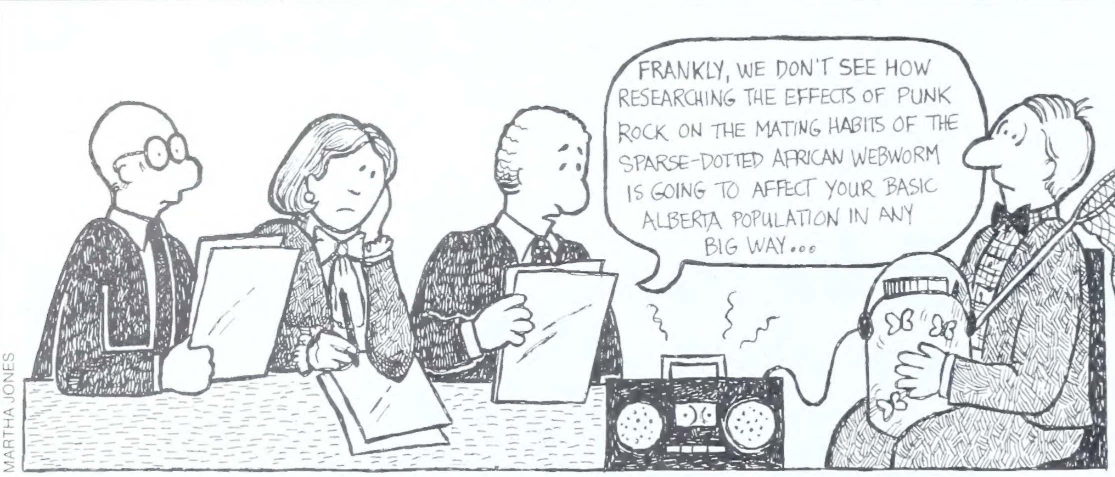
Public opinion, informed (some would say misinformed) by the media, is an important factor in determining priorities for environmental research. (One research manager speaks ruefully of a "pollutant of the week" syndrome.)

This is a matter of concern throughout the scientific world, in fact. Dr. Viktor Sebek, secretary for the Advisory Committee on Pollution of the Sea, wrote in a recent issue of the journal *Ambio:* "Legislative priorities (internationally) ... reflect the degree of attention which particular sources of pollution receive in the popular media. These are more likely to be taken up for action by policy makers than those priorities which scientists perceive as presenting the greatest threats."

But there are other factors. To figure out what they are, it's necessary to remember that environmental research, like any other, involves a researcher submitting a proposal to an individual or organization authorized to allocate funds.

So what is it about some research proposals that makes them more acceptable to the research manager or grants committee or whoever holds the purse strings?

The Alberta Environmental Centre at Vegreville does, among its many other services, applied research on environmental concerns for government departments and


FRANKLY, WE DON'T SEE HOW RESEARCHING THE EFFECTS OF PUNK ROCK ON THE MATING HABITS OF THE SPARSE-DOTTED AFRICAN WEBWORM IS GOING TO AFFECT YOUR BASIC ALBERTA POPULATION IN ANY BIG WAY...

MARTHA JONES

agencies. The centre's executive director, Dr. Sherman Weaver, uses a highly specific list of criteria to judge the appropriateness of research proposals.

For example, the work proposed must be needed by a government user, and must be of high priority for that user (so the formal request must be signed by the deputy or assistant deputy minister involved.) The problem addressed should have environmental consequences for Alberta at least, and preferably for western Canada.

The proposal should reflect a level of public concern; it should be appropriate for interdisciplinary work; it should be technically feasible; it should, if possible, not duplicate work done elsewhere. There should be some probability that the results could be implemented, and the proposal should measure up to a cost-benefit analysis.

The research program developed from the application of these and other criteria is submitted annually to a board of directors, composed largely of deputy or assistant deputy ministers of the main client departments — Environment, Energy and Natural Resources, Agriculture, and Workers' Health, Safety and Compensation.

The environmental research council of the Canadian Petroleum Association has a budget of up to $300,000 annually to spend on environmental problems of concern to the petroleum industry.

Council co-chairman Ron Findlay says this work is almost always applied research. The approach is to survey industry, the government, and the Energy Resources Conservation Board about problem areas, then to contract out the research needed (mostly to private consultants or universities).

A similar approach is used by Alberta Environment's research management division, where research managers work with user divisions within the department to isolate specific problem areas, and then con-

# Unasked questions

How well have we been served by environmental research, and what are the gaps left for study? The view differs depending on where you stand.

Ed Brushett, manager of the ERCB's environmental protection department, speaks of the "excellent research that has gone on in the energy industry." He is pleased that the joint government-industry Acid Deposition Research Program is getting under way.

"I think quite frankly with the Acid Deposition Research Program coming into place now that quite well defined and necessary research is going to occur," he said.

"Some of it probably has not been occurring in the past."

A different perspective comes from Alistair Crerar, chief executive officer of the Environment Council of Alberta.

While agreeing that some good work has been done — especially in air quality research — he identifies research gaps in two main areas.

Physical science research is needed, he feels, on the presence of trace elements in water. There is "reasonable material" on some water-borne pollutants, but no work is being done on new elements continually being added to rivers, streams and lakes.

Crerar also proposes economic, sociological, even legal research on ways to achieve better compliance with existing environmental standards.

"I am thinking here of the kinds of alternatives to our existing ways of doing things — investigation and prosecution," he said.

Economics research, for example, might point to the use of economic incentives to achieve better environmental quality. Legal research might examine the value of civil suits as an alternative to the legal methods now in use.

"I think these are very legitimate areas of environmental research," he said.

With some exceptions, most environmental problems in Alberta have been addressed in recent years, even though Dr. Bob Green, vice president of operations for the Alberta Research Council, points out that public interest has dropped off somewhat today from its high point in the late 1960s and early 1970s.

"The real problem of weakness in environmental research is that environmental impacts or their likelihood are not always apparent before the fact — the infestation of Bertha army worms because of extensive mono-cropping for example," Green says. "Of course there are also situations such as the oil sands where it's obvious that there will be an impact on the environment — and we take action in those cases."

Dr. Percy Sims, director of Alberta Environment's research management division, agrees. "I think we're aware of the critical problems facing us today, and we're either doing research or are in the process of initiating it. That sort of thing depends on available funding and priorities, but the most important areas are covered. This doesn't mean we have all the problems identified — new ones come along all the time. We have to face them as they come and fit them into our priorities.

"In our short history of environmental research we've learned a lot about how to organize ourselves. I think we're now prepared to accommodate whatever comes along."

TIM BIELEC

**Natalia Krawetz and Bill MacDonald**

tract out and manage the resulting research projects.

What can be said about this approach to environmental research?

"It's *not* objective," says Dr. Natalia Krawetz, a research consultant who formerly worked for Alberta Environment's research secretariat, the predecessor of the current research management division.

Ultimately, getting a research proposal approved may depend on who you know, and how well you know them. Krawetz talks of the need to win the trust of administrators to whom one reports. Her husband and co-consultant, Dr. Bill MacDonald, until 1981 the research secretariat's director, recalls that what was funded depended heavily on the relationship between the secretariat's research managers and the people they worked with elsewhere in the department.

This is "brokering," and though it may work very satisfactorily, it certainly isn't part of any formal policy statement.

The Natural Sciences and Engineering Research Council (NSERC) provides funds for much of the environmental research done in Canadian universities.

NSERC research grants director Janet Halliwell notes that, because university research work is "supposed to be at the frontiers," the council steers away from setting overly narrow criteria for the proposals it is willing to consider. And unlike the other groups just cited, part of its mandate is to finance free, basic research, as well as that designed to tackle specific problems.

In the free research program, says Halliwell, no attempt is made to set priorities.

"We look there for the proven racehorse," she says.

"It's the quality of the research and the quality of the proposal."

But what, after all, constitutes a "good" researcher or a "good" proposal?

> ***"There are a lot of areas within environmental science where industry and government are looking for science to answer what are moral or ethical questions," says Dixon Thompson.***

According to Dr. Dixon Thompson, a professor in the faculty of environmental design at the University of Calgary, "good" research all too often has come to mean research that gives good results.

"We can't judge research as good or bad by the results that come out — because what that does is push people towards the low-risk, low-gain end of research," he says.

There also has to be high-risk, high-gain research, where a long shot just might produce a breakthrough.

"You have to assess a research proposal on the quality of the proposal, not on whether or not you expect to get results. Then you have to balance some of that research funding between high-risk-high-gain and low-risk-low-gain. Within government and industry, that is not very well understood."

That's partly because, says Thompson, most of the people who are trained in policy formulation and management know very little about science, and vice versa.

Grants committees made up of administrators rather than scientists may also tend to favor the rational (left-brain) rather than the intuitive (right-brain) approach. So, Thompson feels, it's easier to get money for a very narrowly defined, even "almost trivial" project than for one that involves testing a real hunch.

Another problem of environmental research, identified by both Krawetz and Thompson, is the high expectations it engenders in the people who finance it. Thompson feels there's a widespread notion that if you throw enough money at an environmental problem, you can fix it.

"There are a lot of areas within environmental science where industry and government are looking for science to answer what are moral or ethical questions," he says.

Environmental research may yield helpful background data — but "what is safe" (in terms of, say, lead in the environment) is not a scientific but a value judgment.

Now, if all of the foregoing says something about the people who hold the purse strings, there are also some games that researchers play — and in playing them, play their part in shaping environmental research policies.

When it comes to funding, "grantsmanship" (to use Thompson's term) is an important one.

"There are two ways to go about it," he

T.M.BELEC

T.M.BELEC

Researchers at Kananaskis Centre for Environmental Research laboratory (above) and growth chambers (below).

says.

"You can find a bandwagon that more or less fits your interests, and jump on that. That leads to the difficulty of 'me too' research, where the current hot topic in international research becomes the current hot topic in Canada too.

"Or you can try to convince the funders that the problem you have identified is important enough that you ought to be funded."

There's a "certain set of skills" involved in writing a persuasive research proposal —and certain constraints under which even the most gifted and innovative researchers have to work.

The first is time. Thompson notes that money is very seldom paid to the principal researcher to enable him/her to drop everything but the project in hand. The second is help. Researchers depend heavily on graduate students as assistants, and the quality and scope of what they undertake is often only as good as the students available.

In fact, the current recession has contributed to the research boom which the University of Calgary is now experiencing. There are increased numbers of graduate students enrolled, and, as well, there is less mobility among faculty members in a tight job market.

But given the constraints, it's still possible to get around the system. If preference is being given to short-term funding, "leapfrogging" (Krawetz's term) is a useful strategy. This involves breaking a long-range, broad-scope vision into a series of small, short-term steps.

If funding preferences seem to be for rational, results-oriented projects rather than more speculative ones, "front-end loading" (Thompson's term) may be the name of the game. This involves applying for research money for a project that is actually almost completed, then using the money to back the next project. (This, says Thompson, is one of the few ways to finance "intuitive leaps".)

What sort of research has this rather haphazard approach to policy engendered? There seems to be general agreement that in the past, it's been mostly short-term and narrowly focused. There hasn't been too much of the broad sweep about it.

Indeed, says the Alberta Environmental Centre's Weaver, a lack of interdisciplinary perspective has meant that "the majority of the environmental work done in the world in the last 25 years has turned out to be useless."

On the other hand, the Acid Deposition Research Program, already mentioned, has a seven-year time frame and is certainly interdisciplinary in its approach. The 10-year government-industry land reclamation program started in 1976 also reflects a broader perspective.

Perhaps times — and priorities — *are* changing.

Gillian Sniatynski, the former editor of this magazine, is now a freelance writer and editor living in Drayton Valley

Jim Wilson

# The History of Environmental Research in Alberta

Its roots are in a delta.

MARTHA JONES

Environmental research in Alberta does not have an extensive history, and it probably owes its existence more to the publication of two books than to any carefully-planned development program.

One of the books, of course, was Rachel Carson's *Silent Spring,* published in 1962. The other was *Death of a Delta,* a joint project of Dr. Stuart Smith and several others in 1968 when Smith was director of fish and wildlife in the old Alberta department of land and forests.

"It's difficult to point to when environmental research really started here or anywhere else, because the word 'environment' and its companion word 'ecology' weren't invented, at least in the public mind, until the late 1960s," says Smith, now an Edmonton environmental consultant.

"Certainly environment-related research was being done prior to that, but until those words came into common usage, particularly among young people, the environmental focus wasn't really there."

*Silent Spring,* Smith believes, was "one of the most important indictments of thoughtlessness ever written," and "the modern catalyst of environmental concern." And he terms Rachel Carson "the mother of the environment."

But Smith, as well as Henry Thiessen, now managing director of the Alberta government's Native Secretariat and in the late 1960s chairman of the government's interdepartmental conservation and utilization committee, were the Alberta catalysts for environmentalism.

When the British Columbia government built the giant W.A.C. Bennett hydroelectric dam on the Peace River at Hudson Hope, B.C., Smith and several government and academic colleagues became concerned about how the new water flow in the river would affect a number of environmental aspects in Alberta, particularly fish migration and the Peace-Athabasca Delta region. They found that fish were indeed drastically affected, parts of the delta itself were frequently dry and flow in some related river and stream channels was often reduced to a trickle. *Death of a Delta* was the result of their study, and its publication had an enormous impact on Albertans' interest in events affecting their environment.

> ***"It's difficult to point to when environmental research really started here or anywhere else, because the word 'environment' and its companion word 'ecology' weren't invented, at least in the public mind, until the late 1960s."***

"The time was ripe," Smith says. "People

Stuart Smith

were still responding to *Silent Spring*, the media, particularly television, were doing everything they could to encourage that interest — it just all came together then."

Prime Minister Trudeau and then-Alberta Premier Harry Strom were quick to react to the Smith book. Shortly after its publication, a Peace-Athabasca Delta study group was formed, with the $2-million project funded 50 per cent by the federal government, 45 per cent by the Alberta government and five per cent by the Saskatchewan government. It was certainly one of the first well-funded, broadly-based environmental research programs in Alberta, with a mandate to research the situation and make recommendations concerning mitigating measures which could be taken where problems were identified. The team's report, published in 1972, described a number of concerns and proposed solutions, and many of the solutions were implemented.

During those same years politicians were also getting involved. "There was a great upswing in public concern then about the environment, and governments across North America began setting up environmental research programs and departments," says Dr. Bob Green, vice-president of the Alberta Research Council — the oldest and largest provincial research establishment in Canada.

"Stuart Smith was deeply involved in much of the activity and Henry Thiessen was assigned to draft most of the environmental legislation in the province. Between them, they led the Alberta government into developing a sound entity to look after the Alberta environment."

In fact, Alberta was the first province in Canada to establish a department specifically to look after the environment. As a land conservationist with Alberta Agriculture, Thiessen had been directly involved in many environmental matters. In 1970 he and Smith drafted the Environment Conservation Authority Act, and when it was passed by the Alberta Legislature Smith joined the resulting administrative group.

"There had been a fair degree of impetus in the public domain at that time with respect to environmental concerns," Thiessen says. "There were also concerns within the government, the main one being that as resource managers we needed a stronger means of co-ordinating our activities than we had at the time. The government of the day (Strom's Social Credit administration) chose to incorporate some of its environmental requirements and concerns, and the result was the ECA.

ALBERTA GOVERNMENT PHOTO

Bob Green

Henry Thiessen

"The next step was to bring together some of the government sections that worked with the environment, and to tie together some of the other provincial resources."

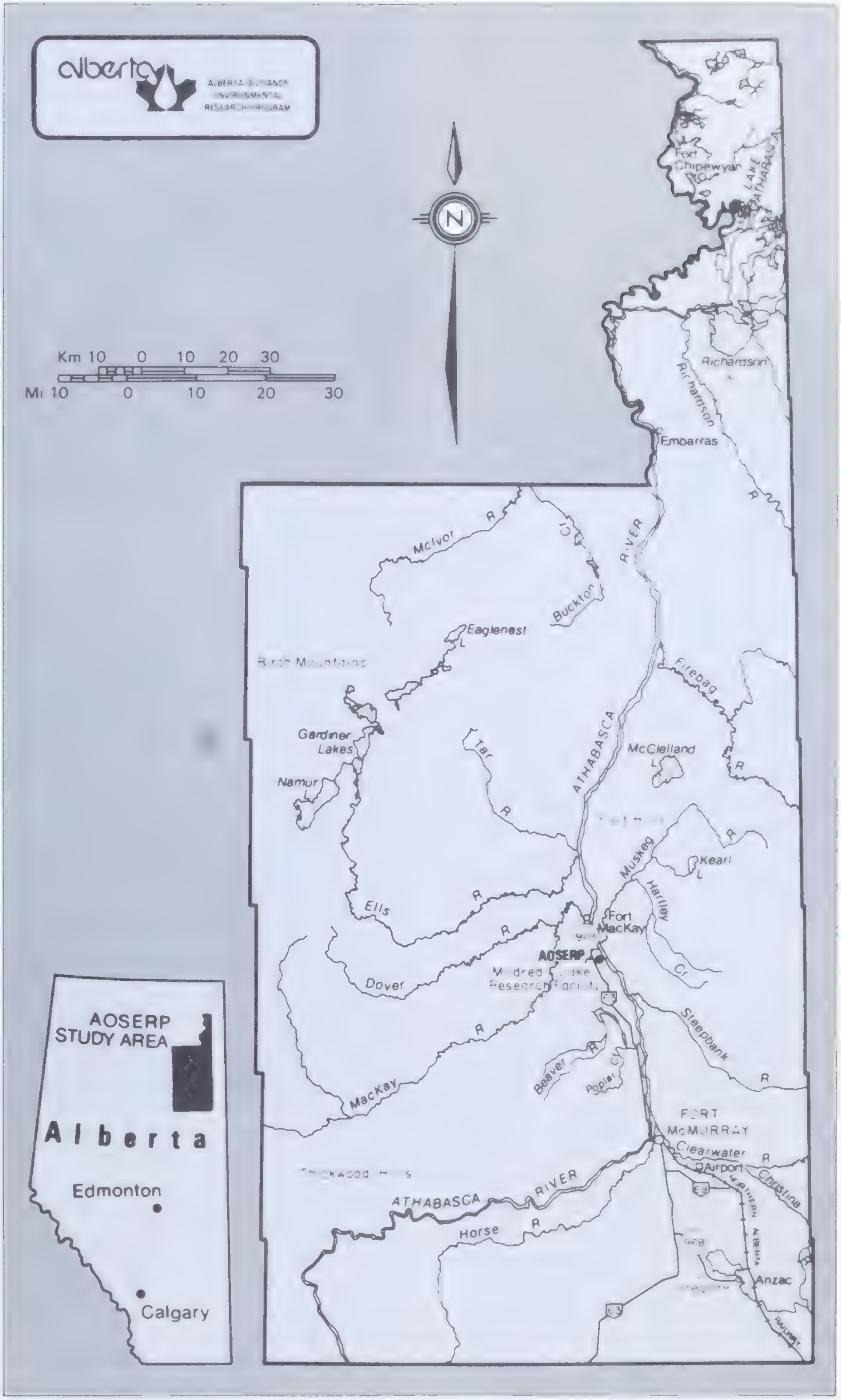
To do this, Thiessen drafted the Department of the Environment Act in 1971, consolidating the Alberta Agriculture water resources division, the same department's land conservation branch and the Department of Health's environmental health services branch. Shortly thereafter the surface reclamation council of the Department of Lands and Minerals was added, creating Alberta Environment largely as it is today.

In 1971 Thiessen also wrote the Environmental Resources Trust Act, and in 1973 added the Land Resources Conservation and Reclamation Act. These four pieces of legislation are the historic foundation of Alberta's contemporary environmental research.

It would be unfair, of course, to suggest there had been *no* environmental research undertaken in Alberta prior to this legislation or to the activities of the 1960s.

"In the broader context there certainly were some individuals and groups looking at environmental matters, even early in the century," says Dr. Bill MacDonald, former director of the Alberta Environment research secretariat (predecessor of the research management division) and now a management consultant specializing in research and development.

"Many earlier projects were more of a health matter, but they still were concerned with our human environment. Some of the early projects involved water and sewage



treatment and disposal of wastes. These kinds of programs would tend to be municipal, though, and municipalities aren't really involved in research — they bring in outside engineers or consultants to undertake them.

"Because of that, the research results were usually pretty minimal, since before about 1973 there really wasn't anyone specifically responsible for research in Alberta. In the early 1900s there was considerable concern over weed growth in Lake Wabamun. After several investigations it was identified as a *problem,* but there was little real research done until the early 1970s — and in fact 80 years after the problem was identified, it's still an issue."

Less formal research has also typically been undertaken by farmers, many of whom are constantly experimenting to find ways to change the environment. "For instance farmers will take grasslands and find ways to turn them into monocultural areas for production of food," MacDonald says. "They'll find ways of moving water into dry regions — and again they'll change that environment."

***Less formal research has also typically been undertaken by farmers, many of whom are constantly experimenting to find ways to change the environment.***

The difference between what is generally accepted as environmental research today and what was taking place in those situations however, is that the intent was to find ways to actually to alter the environment, not to assess the impact of potential alterations. "Other than protection of the water course in an irrigation system for example, I doubt that the farmers were too concerned — or perhaps even aware — of the long-term affects the canals would have on the environment."

(In fact, peculiar situations have developed because of this: in some of the current irrigation system rehabilitation works in southern Alberta, there is great concern over potential detrimental impacts on various birds that nest in or near the canals — birds which could not have survived in the region prior to initial construction of the irrigation system half a century ago.)

The Alberta Research Council's Bob Green agrees there has been a form of environmental research under way for many years, and points out that at the very least much of the data gathered in early years is useful for today's more carefully planned programs. But he objects to simple data-gathering being termed "research."

In the years following initiation of the watershed research program, environmental concern began gathering momentum, culminating in the formation in 1971 of Alberta

Syncrude Canada's oilsands operation and on-site research greenhouses (opposite)

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Environment and several related agencies.

"As soon as you have this sort of entity it looks around to find answers to questions such as how to best enable reclamation," Green says. "It discovers a lack of answers, so it establishes new research programs."

And if Alberta's experience is any indicator, it then begins to quickly learn from initial organizational mistakes.

One of the first major research programs in Alberta based on these new legislative mandates was the Alberta Oil Sands Environmental Research Program, started in 1975 in response to concerns over the impact of petroleum exploitation mega-projects on lands and people in the province's oil sands areas. It was to be a 10-year program, jointly funded by the federal and provincial governments.

Stuart Smith was appointed its first director, but when he became disenchanted with the way it was organized he resigned.

"AOSERP started with an ad-hoc group of federal and provincial government people who established what was considered the required effort to document the impact of plants like Syncrude and Suncor (then called Great Canadian Oil Sands)," Smith says. "The ministers agreed something should be done, and a consultant was hired to put together all the recommendations from everyone involved. Following the report, the two governments entered into an agreement for the 10-year period, with an option to reconsider after five years.

"But four years later, in 1979, the federal government opted out and Alberta Environment completely took over the funding and carried the project to its half-way period in 1980."

The program's most distressing problem, however, was not the federal government's departure. "The way AOSERP was first set up was a dog's breakfast," Smith says. "It was organized in a way guaranteed to fail. It had no statement of purpose and only the most general terms of reference. It had 12 committees, each acting independently — a hodgepodge of groups doing whatever they wanted to do.

"By late 1976 the situation was so bad that the department decided to reorganize it, and asked me to return as director. I reduced those 12 committees to four groups – air, land, water and human systems — and we defined what we were going to do fairly closely. We also started contracting out much of the research, providing a broader input of ideas and talents."

And the changes worked, Smith believes. "That area (Alberta's oil sands region from Fort McMurray to Fort Chipewyan) has been better researched on a broad scale than any area I know of in North America. The baseline information we gathered is still used frequently by many people, and by the midway point of the program in 1980 it had cost only about $17 million."

While Smith is no longer associated with AOSERP, the program is still operating, although not on as broad a scale. In particular it is now concentrating on water and air quality studies. In addition, Syncrude Canada has spent a substantial amount of money in related research programs involving air, water, fish and vegetation affects of its plant.

While several major government-sponsored environmental research programs have been initiated since AOSERP, none have suffered the same birth pangs.

"AOSERP was one of the first mega-research projects undertaken in Alberta, and we learned a lot simply in doing it, not to mention the data it has provided us with," says Dr. Percy Sims, director of Alberta Environment's research management division. "It was our first environmental research project involving a number of government agencies and departments, and as the program went on the management structure improved and in the end a large amount of excellent information has come out of it.

"What we learned in terms of organization has been applied to other large research

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projects such as the Reclamation Research Program and the Acid Deposition Research Program. Both have got off to a much more effective — and deliberately much slower —start."

Dr. Paul Ziemkiewicz, chairman of the Reclamation Research Technical Advisory Committee, agrees that the RRP (funded through the Heritage Savings Trust Fund) has been progressing smoothly.

"Historically in Alberta, much of the reclamation research involved a lot of scattered little projects. Very few of them actually yielded any results — they were too isolated and unco-ordinated, and frequently lacked sufficient funding. Also, many of them didn't have any real situations to study. It's difficult to study reclamation of strip mines, for instance, without having a strip mine to go to.

"These problems were recognized, and our committee was appointed by Order-in-Council and first met in March of 1978. Our membership is from Alberta Environment, Energy and Natural Resources, Agriculture and the Alberta Research Council and through these it includes the Alberta Forest Service and the Alberta Environmental Centre in Vegreville."

The RRP was established for an initial 10-year period to identify the most efficient methods for obtaining acceptable reclamation, and it has quite specific organizational guidelines. It is active in three areas: plains coal, looking at reconstruction of agricultural soils and changes in groundwater related to strip mining; oil sands, studying soil reconstruction on tailings sand, reforestation and related matters; and mountains and foothills coal, investigating soil reconstruction for forestry and wildlife range, reforestation and similar subjects. In addition to government involvement, all projects have substantial input from the industries and specific companies involved.

ADRP is a similarly organized and more recent project, initiated in March, 1983, to study the occurrence and effect of acids in Alberta created by pollution and delivered by mechanisms like "acid rain", and to recommend various courses of action. ADRP is a seven-year, $8 million program funded and participated in equally by the provincial government and industry.

Special provincial government programs aren't the only source of environmental research, however. Federal agencies such as the Canadian Wildlife Service, Environment Canada and Agriculture Canada have been frequent participants — and indeed, data is still being gathered from agricultural plots established by federal agricultural researchers almost half a century ago. Many agricultural, biological and other studies involved in the environment also continue today.

Universities have historically contributed as well: the University of Alberta has several environmental and biological research stations, including one at Gorge Creek, established in 1950. Its director, Dr. David Boag, also recalls his father Thomas working for the Alberta government in the 1920s, investigating environmental problems such as the cause of an epidemic of elk die-offs.

The University of Calgary has operated the Kananaskis Centre for Environmental Research since 1966, and has also been responsible for other environmental programs.

Perhaps the largest and most ambitious provincial program is the Alberta Environmental Centre at Vegreville, first proposed in 1973 just after Alberta Environment was formed, carefully planned and designed in subsequent years and opened in 1981. The centre's purpose — to provide a central facility for study and solution of environmental problems in Alberta — is in keeping with the historic development of environmental concern in the province.

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Catherine Butlin

# *Taking Action*

## Deciding when enough research has been done and it's time to act.

DAVE MUSSEL

Finding answers to environmental research questions is only half the battle.

Deciding whether to act on that research or to wait for more results is the other, more controversial question, one that is in the hands of politicians and industry.

Whether society can afford to delay acting on a problem until persuasive or conclusive evidence is in, or whether it should take some remedial measures immediately, gathering further data as it proceeds, depends upon the problem. Obviously, the consequences of action or inaction should be a major consideration in such decisions.

For example, there is a correlation between eggshell thickness and DDT use — birds exposed to DDT have been found to produce eggs with such thin shells that they often break before hatching.

When this was documented during the 1950s the decision had to be made whether to take action, and to what extent. DDT was eventually banned in North America.

The DDT problem is an example of a situation in which research can provide a conclusive answer. A decision can then be made to act or not on the basis of that answer. A contemporary example of such a neat problem is the search for a method to remove cysts of the parasite giardia (the cause of "beaver fever") from the water supply, says Dr. Percy Sims, director of Alberta Environment's research management division.

"Once that's found, the problem is solved," he says.

Implementing the solution in a case like this is then a matter for government, taking into consideration such factors as the cost of new technology required.

Where the cause-and-effect relationship in an environmental problem is less clear, the dilemma is this: Can society afford to wait for the long-term, often costly, research which would offer conclusive proof that action is needed?

***The dilemma is this: Can society afford to wait for the long-term, often costly, research which would offer conclusive proof that action is needed?***

Dr. Dixon Thompson, a researcher at the University of Calgary's Faculty of Environmental Design, believes the question to be asked in this and any other decision on whether to act on environmental research is: "If we don't act now, and the worst case comes about, are you prepared to live with what happened?

"Take for example the effect of lead in

Field work (opposite and below) is an integral part of much environmental research

Spraying test plots to assess effects of herbicide (left).

gasoline. We only had statistical proof it was harmful when we went ahead with catalytic converters. But would we be prepared to wait another five years while researchers diddle around getting concrete proof while people continue to be exposed to the toxic effects?"

Such decisions are complicated by the difficulty of obtaining conclusive results from environmental research.

While pure scientific research can be motivated by curiosity, most environmental research is aimed at solving specific problems society faces, Thompson says.

Solving these problems requires applied research cutting across many scientific fields, says Dr. Allan Legge, a researcher at the University of Calgary's Kananaskis Research Center. A single research problem may involve atmospheric chemistry, atmospheric physics, plant biology, soil biology and chemical engineering, notes Legge, who has done extensive work on the effects of sour gas emissions on vegetation. "Unfortunately," he says, "You may have to deal with all of these at the same time. Someone has to be able to piece together all the results."

In the environmental research process, a scientist will also have to move between pure and applied research, although, as Thompson says, there is no clear dividing line between the two.

"It's difficult to say you do one or the other," Legge agrees. "You end up having to do some of both."

In the past, the specialized approach of the pure scientist has raised major roadblocks to environment research, says Dr. Sherman Weaver, executive director of the Alberta Environmental Centre.

"Everything has been compartmentalized", he says, with the result that much of the environmental research done in the past has been "worthless" as a basis for action to be taken by government or industry.

The interdisciplinary approach necessary for successful environmental research is often difficult to achieve with researchers trained in a narrow scientific specialty.

As well, "pure scientists never feel there has been enough research", says Dr. Natalia Krawetz, a research management consultant. Their research findings are generally not released until after an "internal, gut-wrenching dilemma, and only then with six caveats, two constraints and six fences around them."

Getting the answers to environmental questions is a difficult, time-consuming process. Deciding when the time has come to act on the research available or whether to continue to gather evidence requires a value judgement, says Thompson.

Researchers often feel the timing of projects is too short. It is not unusual for funding to run out before an important research question is answered, says Legge. Funding agencies may not appreciate that "the environment is resilient" so that effects of a pollutant may not become apparent within

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MARTHA JONES

the time frame of a short-term project, he says.

In many cases society demands immediate action on a complex environmental question before long-term research can be completed. In these situations, Sims says, one option is to release existing information for immediate action with the caveat that it is based on only limited data, and its value gauged accordingly.

Another constraint on environmental research as a basis for action is the tendency of funding agencies to require some guarantee of success before agreeing to provide funds which may be in short supply.

Weaver says "likelihood of success is a factor" in deciding whether a project is undertaken by the Alberta Environmental Centre.

Thus, for example, since a recent extensive survey of fish flesh for pesticides "didn't reveal anything of consequence, we wouldn't recommend (a similar project) be undertaken every year," he said.

Other scientists object to having to guarantee results for funding agencies. "If you already know the answer, you're doing trivial research," Thompson believes. He points to a recent, expensive federal study on cadmium which uncovered no cause for public concern at present levels and which the federal Treasury Board objected to as unnecessary. However, Thompson points out that "finding out something is not a major problem doesn't make it a bad piece of research."

***The findings of pure scientists are generally not released until after an "internal, gut-wrenching dilemma, and only then with six caveats, two constraints and six fences around them."***

Here in Alberta, a decision not to inquire into a possible link between the Lodgepole sour gas well blow-out and spontaneous abortions in the affected area was at least partly based on the likelihood of achieving results, says Thompson. A past outbreak of rubella in the area and the lack of basic research knowledge on the health effects of hydrogen sulphide rendered the chances of finding a conclusive link slim, it was decided. That, combined with the huge cost of an adequate study, killed it, he says in a decision "which made some people very unhappy."

Public pressure is an important factor in deciding whether a piece of research will be funded or whether it will be acted upon, says Krawetz. "People tend not to be turned on by wildflower counts," she says. They are very interested, however, in whether they could get leukemia from industrial emissions or whether their water supply could be contaminated by hazardous waste storage. Krawetz believes this sensitivity to public concerns results in far more research funds going to applied rather than pure research questions, to problems that "affect the food we eat, or ourselves."

The exposure of Albertans to low levels of sour gas emissions over the past four decades is an illustration of some of the difficulties of deciding when enough data have been gathered to justify action. As with many environmental questions, says Sims, the effect of gas plant emissions is complicated and confounded by other factors. Moreover, since the effects of low-level exposure are cumulative, even if ten years of research reveals nothing, nothing is proven, since the danger threshold may be reached in the following decade.

Thousands of dollars have been spent on researching sour gas plant emissions but conclusive results have proved elusive. Most researchers and government spokesmen agree much more research is needed on the

TIM BELEC

**Sherman Weaver**

effects of low level exposure on plants, soils and especially on people.

Despite the lack of conclusive evidence, however, the province has imposed emission control standards on operators. In this case, action was taken while research continues, in response to intense public concern. The sufficiency of that action, however, has also been the subject of intense controversy.

The people of Pincher Creek, living downwind from two aging sour gas plants have been complaining of severe health impacts for years. The symptoms include nose bleeds, vomiting, headaches and screaming fits in babies. Albertans' consciousness of possible health effects from sour gas plant emissions throughout the province have been raised by the publicity the Pincher Creek complaints have received. The complainants have been the subject of some research, although its methodology and extent have been severely critized. The Pincher Creek research has found no conclusive link between health complaints and sour gas plant emissions. Thompson points out it is a truism of science that failure to find proof proves nothing. But he believes researchers may have to go very far afield to find any answer to the Pincher Creek question. For example, further research may reveal genetic predilections toward sensitivity in the people there. "If there was an obvious answer, it would have been found by now," he said.

Given the existence of some research information on the effects of the sour gas industry, decision makers then have to ask, "to what extent is it reasonable for society to act to protect people?" said Thompson. Economic and technological feasibility are as important factors as public opinion, "and with some justification," he said. If the technology isn't available to implement them, "Why set standards?"

Present sour gas emission control systems catch 97.5 per cent to 99 per cent of the sulphur dioxide removed from the gas. The technology to improve the recovery rate to 100 per cent is available but its costs are enormous and government has not been willing to impose such a crippling standard on the industry thus far.

Decisions about environmental protection standards should be based, to some extent, on scientific research, agree researchers and government spokesmen. But there's feeling research plays a small role in setting standards, which tends to be left in the hands of "public servants with engineering backgrounds," says Krawetz. While standards are "supposed to be based on scientific fact," Legge believes "political decisions may be reached regardless of that fact." This may be necessary, he concedes, if sufficient facts are not available so that "a guess, based on best available information," has to be made.

As is the case with other examples of taking action based on environmental research, setting standards is often a matter of value judgements.

Such has often been the case in setting Alberta standards, many of which are based on American research or data from other provinces, says Sims. There is usually a range, from less to more strict standards available, and Sims believes in view of the foreign origin of the information, "the department will tend to make them more stringent."

Alberta participates in a federal/provincial subcommittee which monitors these standards and any new information relating to them, "based on world-wide research," says John Defir, director of Alberta Environment's standards and approvals branch. "The fact that some Alberta standards come from elsewhere is taken into account during this review."

**John Defir**

But when Alberta Environment sets such standards as those for emission controls on sour gas plants, other factors than scientific research come into play, as noted above. These standards are set in consultation with the Energy Resources Conservation Board, with the ERCB providing information about economic and technological feasibility of emission controls, Defir says.

New research questions arise constantly in the environmental standards area, says Dr. Harby Sandhu, senior research manager with Alberta Environment. Pollutants which he believes require further research include vinyl chloride, asbestos fibres, and the heavy metals produced by tar sands plants. Where information is not complete and the problem warrants it, an interim standard can be set until research is completed, he says.

Catherine Butlin, a former journalist, is now a law student and freelance writer in Calgary

Sharon Adams

# *Funding Environmental Research*

## Who pays?

T.M. BELL F.

*"An industrial society which cuts back on its research and development during economic recession is akin to an agricultural society which eats its seed grain during periods of drought."*

*The Research and Science Advisory Committee, March, 1984*

If research is the basic stuff of life in a technological society, then Alberta is well-fed even in lean times. In 1981-'82, according to Statistics Canada, Alberta ranked third (behind Canada and Ontario) with its $523 million expenditure, accounting for 12 per cent of the nation's research and development.

While the recession may have caused portions to be reduced on other plates, Alberta researchers generally have not been on a starvation diet; in some areas, they even have their pick at a funding buffet.

***While the recession may have caused portions to be reduced on other plates, Alberta researchers generally have not been on a starvation diet; in some areas, they even have their pick at a funding buffet.***

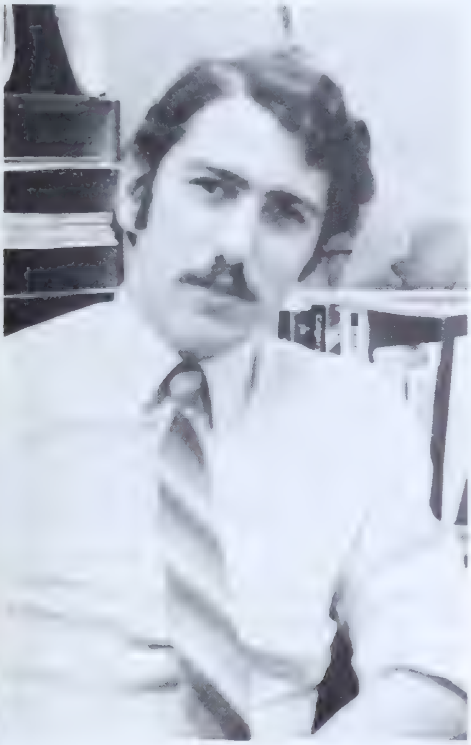
Research services grants officer William Feldstein reports the University of Calgary, at least, is "in a research boom cycle." Even government, currently in a belt-tightening phase, has not cut back research as severely as other expenditures. Dr. Alan Vanterpool, director of the Office of Science and Technology, says the "Alberta government sees research and development as one of the tools to help government departments and agencies reach their goals and objectives."

But does environmental research have as much room at the funding table as research identified by the senior governments as helping Canada maintain its international technological competitive edge? Although the interdisciplinary nature of environmental science makes tracing funding for its research almost impossible, it seems that it is receiving its fair share.

Dr. Sherman Weaver, executive director of the Alberta Environmental Centre, an

DAVE MUSSELL

environmental research facility in Vegreville, says "Environmental research is entirely discretionary. (Governments and industry) do not have to do research. But not to do it is very unwise."



TIM BELEC

**William Feldstein**

Dr. Percy Sims, director of Alberta Environment's research management division, points out though research is at high risk in tough times, "In terms of comparable organizations, this department at least keeps up, and is probably more supportive (of research)."

But isolating environmental research funding from general research support is like unravelling one noodle in a plate of spaghetti. Of the $523 million spent in '81-'82, Alberta contributed $237.5 million, of which only $13.6 million was ear-marked for "environmental research." But the province also spent $53.1 million on natural resources research, $18.3 million on research on food and related areas, and $95.4 million on "advancement of knowledge" — mostly in its grant to universities.

Adding to the tangle are joint funding arrangements (in which various parties contribute either expertise, money or capital equipment) and the very method of counting funds, which can be tallied twice, as in the case of governments which earmark funding for research and development, then transfer the funds in annual grants to universities to support basic research.

Government and industry pay for the bulk of research in the province, while the research institutions and universities they support spend most of the research dollars.

Industry contributed $284 million of the $523 million research in the province in '81-'82, mostly for research in the energy field.

George Lesko, director of Syncrude's environmental office in Edmonton, says industry generally supports research in several ways: through in-house research operations, such as Syncrude's lab, by paying consultants for research, supporting industry associations' research efforts, funding specific industry-related laboratories, supporting university research, or through joint funding arrangements with government.

Syncrude's environmental office has a $1.5 million annual budget and "most of it goes to environmental research," Lesko says. "The company is generally interested in environmental protection and reclamation. It wants to do its operation with the minimal damage and wants to find ways to reclaim land after the damage has been done."

His department has remained virtually "unaffected by recession," and he says "we still fairly effectively do what we want to do."

Aiding industrial research are three provincially-supported research parks — run by the University of Calgary, the Calgary Research and Development Authority and the Edmonton Research and Development Park Authority.

Although the recession has put development of two of the research parks on hold, the 42.5-hectare U of C research park houses about a dozen tenants, many of whom are involved in environmental research.

Most of the remainder of the $523 million in research funds in '81-'82 came from the province, which accounted for $237.5 million. Individual departments, including Alberta Agriculture, Advanced Education, Environment, Energy and Natural Resources and Recreation and Parks, support research.

**Alan Vanterpool**

Due to the province's privatization policy, most research is not done within the departments requiring research, but is contracted out to universities, government agencies and private contractors.

Of Alberta Environment's research management division's $3.2 million budget, $1.5 million is earmarked for research, and an additional $340,000 for the Alberta Environmental Research Trust. Director Sims says "through co-operative projects with other departments, Alberta Research Coun-

T.M. BELL

cil, the federal government and industry, we are able to supplement our funding." It's impossible to miss the satisfaction in his voice when he adds: "We come close to doubling our research budget."

He estimates his division, through joint research projects, is involved in another $2.5 to $3 million in research.

Like most government departments, Alberta Environment funds "practical-oriented research" because "generally we expect an answer to a problem." The department's practical research is done by the Alberta Environmental Centre, or under contract with private researchers or the universities.

The Alberta Environmental Centre's Weaver reports a "stable base" financially, despite the recession. Of its $11.5 million '83-'84 budget, two-thirds was devoted to applied research and one-third to "services" — testing water samples, for instance.

But the centre cannot handle all the research requested by government departments; five per cent of its budget is reserved for outside work. Weaver says there are 12 to 15 projects a year that must be contracted out because the centre either doesn't have the expertise to handle the research, is fully committed and hasn't time to tackle it, or lacks space and equipment.

Again, Weaver is interested in maximizing meagre resources. There's always more work than money, and he's found joint funding of projects gives "good value for the money." Sometimes a university provides the researcher's salary, and the centre provides the space and equipment.

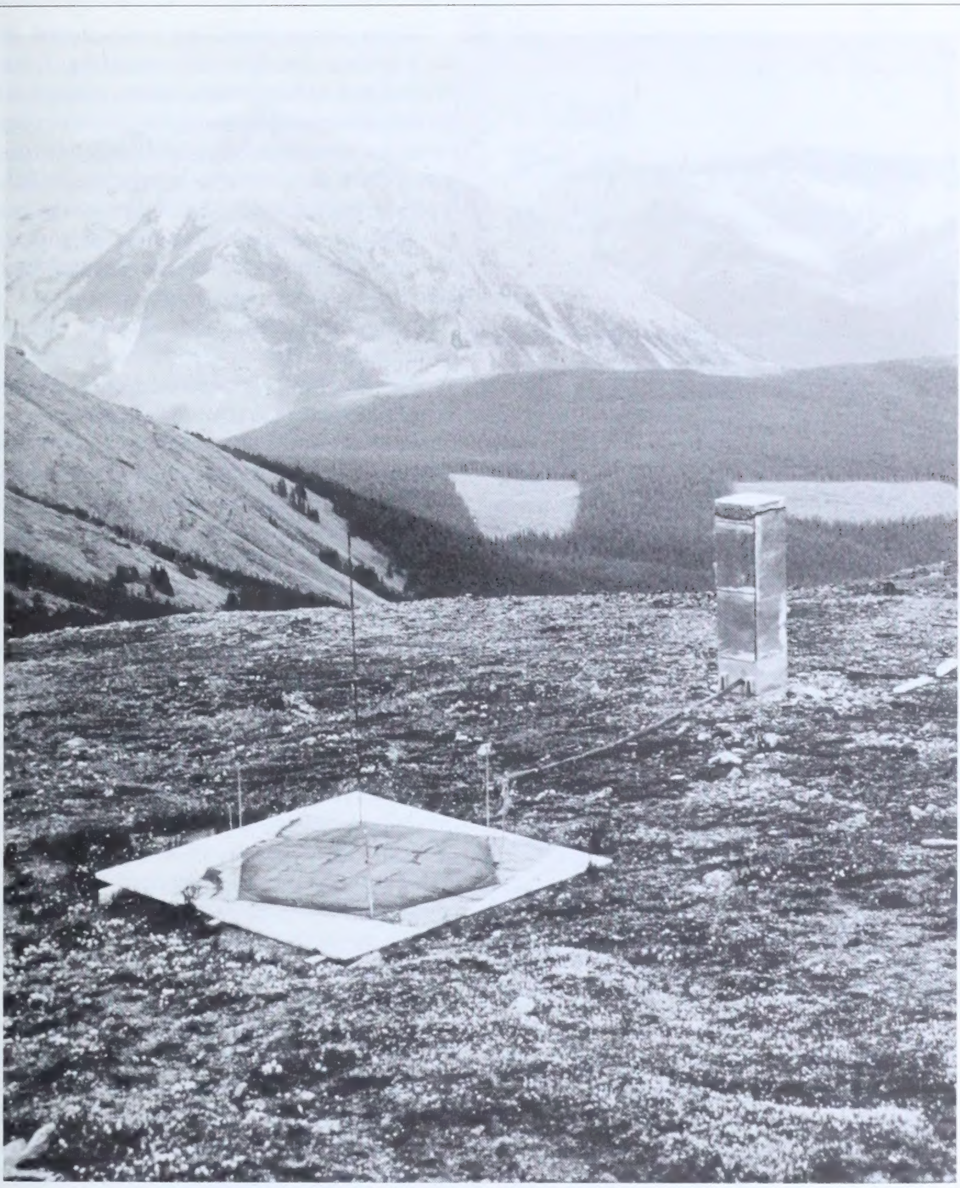
But not all departmental money goes only to applied research. Sims says Alberta Environment, for instance, has earmarked about $330,000 in '84-'85, for "curiosity" or basic research, primarily through projects funded by the Environmental Research Trust.

Established in 1971 to fund research "that may not otherwise be funded by industry, university or government departments," the Trust received $563,000 support in 1983 (including $440,000 from the province and Alberta Environment and $63,000 in private donations). That same year, it disbursed $557,369 in research grants, dipping into unexpended funds from the previous year.

Both the federal and Alberta governments have identified research and development as high priorities, and both have backed that policy with increased funding. The Alberta Oil Sands Technology and Research Authority, the Alberta Environmental Centre, the Alberta Heritage Foundation for Medical Research, and the Alberta Research Council have injected large amounts of research funding.

Universities, which supply large pools of expertise, also report a rich research diet. Statistics Canada reported that in 1981-'82, Alberta's three universities received research grants and contracts of $61.5 million, while one-third of their operating budgets also supported research. In 1983-'84, U of C and U of A together received $78 million.

Bob Armit, director of the University of Alberta's office of research, says more funding is available and more projects are being supported than ever before. "There's more research." The U of A had $47 million in research support in '83-'84, while in '75-'76, the total was $13 million. But it would be almost impossible to break down what pro-



DAVE MUSSELL

portion is devoted to environmental research.

"Research is a decentralized activity," he says.

Of the total, the Natural Sciences and Engineering Research Council of Canada (SERC) contributed $12.8 million, the Heritage Foundation for Medical Research 11.8 million, the Medical Research council, $5.4 million and the Agriculture Research Fund, 2.4 million.

Yet that $47 million reflects, Armit says, the minimum research funding. The U of A also has 30 associated institutes which may receive research funding above and beyond that which comes via the university.

U of C's Feldstein agrees. "The demand is there and there is the political will in the country. The competitive pressures are on."

But while funding for research has increased exponentially, capital and operating budgets have had only modest growth. The result is that research space is at a premium. "It's critical. One of the criteria now on any award application is, is there space and equipment to do the research?"

U of C research activity has grown from $10.97 million for 538 awards in '79-'80 to $30.96 million for 1,355 awards in '83-'84. About half the research funding comes from the Alberta Heritage Foundation for Medical Research ($8.43 million) and NSERC ($7.32 million).

The U of C has associated with it a number of agencies devoted exclusively to environmental research, including the Kananaskis Centre for Environmental Research, the Arctic Institute of North America and the Faculty of Environmental Design. These agencies, too, can receive funding above and beyond that which is registered by the grants office.

The U of C has broken down its funding into categories. Of the $31.464 million dollars registered in 83-84, provincial, federal and private agencies, departments and foundations' donations account for the lion's share.

It seems Alberta has an increasing appetite for research funding, an appetite restrained only by lack of funding for facilities.

Sharon Adams is a Calgary journalism instructor and freelance writer.

*Letters continued from page 4*

Dear Editor:

I would appreciate receiving regular copies of *Environment Views.* Your recent issue on river basin planning was very useful to me in my work and I would appreciate receiving copies of your excellent publication.

Thank you.

C.A. McGregor, Manager
Resource Appraisal Section
Alberta Energy & Natural Resources

Dear Editor:

The cover illustration of the May/June issue, depicting water from a tap filling the cups of many users, aptly illustrates the prevailing attitude in river basin planning. Water is still treated as a useful liquid which can be shipped, diverted, and detained at will, according to where it is needed.

There is much more to a lake than just the water in it; but the idea that lakes (and rivers, swamps, streams, and the rest) are not just natural plumbing, but viable and essential ecosystems, apparently has not yet penetrated, or else is not considered important. River basin planning will only begin to make environmental sense when "management of water resources" is replaced by protection of our aquatic ecosystems.

Barry Taylor
Dept. of Biology
University of Calgary

Dear Editor:

It was with great interest that I read the recent issue of *Environment Views* (June 1984- "River Basin Planning"). This issue would provide excellent background reading for our students in "Biology and Human Affairs" in which we discuss current environmental issues pertinent to southern Alberta.

Dr. Stewart Rood,
Department of Biological Sciences
University of Lethbridge

# Viewpoint

# Natalia M. Krawetz

Dr. Natalia Krawetz is an
Edmonton research management consultant.

TIM BELEC

If you ask most people how research comes into use, the answer would go something like this: Scientists do research and publish the results; then users read about them and use what they see fit. Yet the utilization process remains mysterious to most of us.

I am confident that putting research to use is a social process, helped or hindered by factors like networking, the degree of support from senior personnel, and perceptions of the credibility of both the organization and the scientist from whom the research originates. And there are over 10,000 studies to support my view that users don't immediately pounce on every available piece of information, rushing to put it into use.

In fact, nonscientific factors are just as, and in some cases, more important to useability, than the research results themselves. One such factor, the persistence of a committed individual or "champion", has come into vogue with the recent bestseller, *In Search of Excellence.*

To bring these points to life, let's look at a "champion" in operation. The case: determining the provincial objective for ozone.

Ozone is a naturally occurring photochemical product, formed by the interaction of solar radiation and atmospheric chemicals. While it does not come from industries or cars directly, it can be produced by the hydrocarbons and nitrogen oxides they emit in the presence of the sun. As such, ozone is a component of what is commonly referred to as smog.

The most serious damage resulting from rising ozone levels is to materials — the rubber on our tires is chewed up, for example. And too much ozone can be toxic to plants, as well as irritating to the eyes, nose and throat. What then is "too much"?

"This" is determined by a complex process in Canada. One input is a worldwide review of the scientific literature, prepared by the National Research Council as a public document. This document and other sources are considered by a subcommittee of the Federal-Provincial Committee on Air Pollution, in developing the criteria for objective-setting. From these deliberations come a recommended range of permissible National Air Quality Objectives (actual numbers) which is submitted to Environment Canada.

Given these guidelines, each province sets its own objectives, taking economic, political and social factors into account. Of note here is Alberta's policy of having the most stringent objectives in the country. So, in accordance with federal-provincial guidelines and government policy, Alberta chose the most stringent of the recommended objectives for ozone.

When ozone levels were monitored in the province, the data were puzzling. Even in rural and non-industrial areas, where you would least expect it, the objective was being exceeded periodically for no discernible reason. Urban data were as intriguing. In Edmonton, for example, the objective was exceeded in the summer but not in the winter. No one could account for this seasonal variation.

In parallel with these activities, Dr. Harby Sandhu, then a researcher at the University of Alberta, had a scientific hunch about ozone. His interest related to two factors. First, at the time, there were no scientific studies of ozone in cold, dry climates like Alberta's (and regional climatic factors are known to be influential). Second, scientists believed that ozone production was not problematic in Canada, because it lacks the intense sunlight of places like California. However, Sandhu reasoned that a combination of duration *and* intensity of sunlight was responsible for ozone production. This suggested that, for example, Edmonton ought to have high levels of ozone in the summer, because of the interaction of the essential ingredients (hydrocarbons and nitrogen oxides) with the 14 to 15 hours of intense, daily sunlight. So he submitted an unsolicited proposal on the topic, and was funded by Environment's Research Secretariat in the spring of 1974.

Over the next 18 months, Sandhu pored over the department's monitoring data. He calculated the levels of ozone that would be produced in the urban airsheds of Calgary and Edmonton (given the levels of nitrogen oxides and hydrocarbons, and the duration and intensity of the sunlight). He was able to show that high ozone levels in summer were indeed related to the long, intense hours of sunshine; while in winter, low levels were related not only to less sun but also to the fact that frequent inversions trapped the ozone, which was then consumed by the nitrogen oxides and hydrocarbons in the atmosphere. In other words, he was able to show the rationale behind urban seasonal variation.

In general, his verdict was disconcerting: The total ozone concentration expected in Calgary and Edmonton was bound to exceed Alberta's objective (assuming a reasonable background level, i.e. a level that could expected to occur naturally in the absence of industry or cars, and adding the pollutant level expected in these cities because of photochemical interaction). Also, he recommended that measurements of background level be taken in other parts of the province, since there was no such information at the time. (Naturally high levels of ozone in some parts of the province were confirmed later.)

Sandhu is the first to admit that he ruffled more than a few feathers with his report, which was critical of some departmental monitoring practices. His report was tabled in the legislature and this resulted in questions from the opposition about the implementation of its recommendations. (Most have been implemented.)

It took time for his findings to be recognized as valid and in the interim, Sandhu marshalled other scientific evidence in support. After joining the department's research secretariat, he took advantage of the opportunity for frequent contact with the environmental managers who could implement his recommendations; he persisted in the hopes of their acceptance. But one concern remained an impediment: How does an organization responsible for environmental protection credibly say that one of its objectives is *too stringent?* Sandhu made it clear that he could fully address any public concerns that might arise with a change in objective. (There were none.)

On August 13, 1979, Alberta's ozone objective was officially revised, in accordance with Sandhu's findings.

While his strong feelings show when he describes these events, he admits that the battles were fruitful. Of the environmental managers he says, "I learned from them and am now more sensitive to their needs. Now we can sit down and disagree with one another, and no one is afraid to change his mind in the face of new evidence. I am a firm believer that research, standard-setting and monitoring go hand in hand. And over time, we have been working in this direction."

Are the dynamics of this process specific to Alberta Environment? Not at all. There are similar cases in every public and private sector organization. In my opinion, four years is not a very long time for a large organization to absorb new information. And that is what research results are.

By introducing new information into an organization, a scientist, at least implicitly, demands change. The organization responds selectively, for if the mere presence of information was all that it takes for action, every one of our institutions would collapse. That is, each institution would be so busy responding in so many different directions, that there would be no time for the organization to maintain a sense of coherence.

One way to prod the natural inertia that results is to have a credible and respected messenger of change. With the scientist-nonscientist interface, that is not always the case. In most organizations, scientists are seen as marginal. And the burden of proof remains with scientists to convince us otherwise. Most people don't understand what scientists do or the purpose they serve. Usually, it is left to the scientists themselves to bridge the gap. Perhaps what we really need are more 'bridge scientists'.

Prepared by Doug Ramsay

# *Using Environment Views in the Classroom*

*"If a question is worth asking — is it worth time and funding?*

The area of environmental research poses a number of interesting questions ranging from control to funding. Because environmental research crosses interdisciplinary lines it is not surprising that this topic for use in the classroom also must be covered in a interdisciplinary manner. There is no distinct social studies or science focus to the topic, however many interesting issues do arise that would be useful in either discipline.

There are four different issues concerning environmental research, which are summarized below, with suggested questions. The issues are broad and the questions controversial, which should provide stimulating debate in the classroom.

## Issue I: Environmental Research

Environmental research itself is an issue that students could explore. Because environmental research in the 20th century has moved from attempting to change the environment to suit a certain situation, to assessing the impact of changes on the environment (both before and after changes occur), a new and environmentally more important meaning has developed.

- What is environmental research?
- How and why has environmental research progressed?
- What are the strengths and weaknesses of environmental research?
- Should environmental research be carried out on a discretionary basis?

## Issue II: The Cost-Benefit Factor

In many areas of society seemingly limitless amounts of money could be spent on research. This is true of environmental research and the same cost-benefit debate over funding found in any area of research is also true for environmental research. Debate occurs over issues such as who judges the benefits of research to society or even whether funds should be allocated on a cost-benefit formula at all. As well, tied into cost-benefit calculations about research are problems such as conflicts between the public wanting fast solutions from research and researchers wanting more time to complete their projects. Students could debate some or all of the following questions:

- How much can society (directly or indirectly) afford to pay for environmental research?
- Who should judge the benefits to society?
- Is the cost-benefit approach the correct way to determine funding for research?
- What other approaches could be taken?
- Should the philosophy be that if a question is worth asking, it is worth time and funding?
- Who should determine the acceptable length of environmental research?

## Issue III: Who pays?

Once the issue of cost-benefit has been clarified another question beomes critical; who pays for environmental research? Problems can (and do) arise over whether the public, government or industry should pay and the exploration of this topic will give students insight into the problems of financing research.

- Who should pay for environmental research: the public (directly or indirectly), the government or industry?
- To what extent is environmental research supported in Alberta and who supports it?

## Issue IV: What Becomes of Environmental Research?

This issue is perhaps the most difficult to deal with because once research has shown that something is wrong the problems are just beginning.

- When should action be taken on the results of environmental research?
- To what extent is it reasonable for society to protect people from environmental problems?
- Who should determine priorities for action from research?
- Should public pressure influence the decision to take action or not?

If undelivered, return to:

Environment Views
Alberta Environment
9820 - 106 Street
Edmonton, Alberta T5K 2J6

# Environment Update

## Environmental Education — International Perspectives

The National Association for Environmental Education is organizing a conference on *International perspectives on environmental education: issues and actions* to be held at the Chateau Lake Louise, October 5-9.

For further information contact Jim Martin, Environmental Educational Resources Branch, Alberta Environment, 427-6267.

## Oil and Fresh Water

There will be an international conference on *Oil and Fresh Water: Chemistry, Biology, Technology,* sponsored by agencies including Alberta Environment, Environment Canada, the Natural Sciences Engineering Research Council of Canada, and the Petroleum Association for Conservation of the Canadian Environment. The conference will feature eight invited presentations by international experts, followed by two days of contributed papers. The conference will be held at the Westin Hotel in Edmonton October 15-18. For further information and registration contact: Steve Hrudey, Dept. Civil Engineering, University of Alberta, Edmonton T6G 2G7. or call 432-5122.

## Solar Energy Conference

The Solar Energy Society of Canada, Inc. (SESCI) will hold its 10th annual national conference at The University of Calgary, August 2-6.

The conference will attract some 400 delegates from around the world to attend technical sessions, present papers and participate in workshops. In addition, about 2,000 people from Calgary and surrounding area are expected to attend a trade show.

For further details contact Bill White — publicity and promotion co-ordinator for the conference at 284-7429.

## Retirement

BILL MCKEOWN

Bill Flook, director of liason for the Environment Council of Alberta, has retired as of June 30. Mr. Flook was with the ECA since its establishment in 1971 and has become one of the most knowledgeable people in the province about the public hearing process. Mr. Flook will act as a consultant in this field following his retirement.

## Water Resources Conference

The Canadian Water Resources Association, Alberta Branch, is holding its annual conference in Red Deer October 30 and 31. The topic is *Drinking Water Quality in Alberta.* For further information, contact Gus Ribiero, registration chairman c/o ECOS Engineering Services, Ltd. #201, 11830 - 111 Ave. Edmonton 452-0090.

## Banff Centre Courses

The Banff Centre School of Management has announced its 84-85 resource management programs. For registration or further information, contact Susie Washington, Program Manager, Resource Management Programs, 762-6100.

*Environmental Protection and Resource Development: Convergence for Today* September 6 - 9.

*Project Assessment: Project Audit* September 30 - October 5.

*How to Present Environmental Evidence* October 28 - November 1/or 2.

*Native Canadian Relations and Resource Development Issues* November 25 - 30.

*Integrated Approaches to Resource Planning and Management* January 20 - 25.

## Regulated Streams

The Third International Symposium on Regulated Streams will be held in Edmonton, August 4 to 9, 1985, under the sponsorship of Alberta Environment and the University of Alberta. The major topics for discussion will be instream flow requirements, thermal resetting, nutrient spiralling downstream of reservoirs, modelling regulated streams, effects on watersheds, interbasin transfers, behaviour in reservoirs.

For further information, contact: Hal Hamilton, Alberta Environment, Pollution Control Division, 2nd flr. Deerfoot Square, 2938 11th St. N.E. Calgary T2E 7L7 297-8271

## The Future of Water Re-use

The third international symposium on Water Re-use will be held in San Diego, California, August 26-31, 1984. This week long meeting, administered by The American Water Works Association Research Foundation, will be dedicated entirely to renovation and re-use of wastewater from all sources and the recycling of water by individuals, municipalities, industries or agriculture.

For further information contact Jon DeBoer, AWWA Research Foundation, 6666 West Quincy Ave., Denver, Colorado 80235 USA (303) 794-7711.

**If you have a short news item of province-wide interest you'd like to contribute to Environment Update, please send it to the editor at the address on the Contents page. The editor reserves the right to select and edit the items.**